

What is claimed is:

- 5    1. A magnetic random access memory (MRAM) device comprising:
  - an array of magnetic memory cells;
  - a plurality of word and bit lines connecting columns and rows of the memory cells, each memory cell having a magnetic reference layer and a magnetic data layer, each reference layer and each data layer having a magnetization being switchable between two states under the influence of a magnetic field; and
  - a plurality of heating elements each proximate to a respective reference layer, each heating element in use providing for localized heating of the respective reference layer so as to reduce the coercivity of the reference layer to facilitate switching of the reference layer without switching of the data layers.
- 15    2. The MRAM of claim 1, wherein:
  - each reference layer has at a first temperature a coercivity that is lower than that of each data layer at the first temperature.
- 25    3. The MRAM of claim 1, wherein:
  - each heating element is a heat-inducing layer.
- 30    4. The MRAM of claim 3, wherein:
  - each heat-inducing layer is a resistive layer.
5. The MRAM of claim 3, wherein:
  - each heat inducing-layer is a dielectric layer

through which in use a tunneling current is directed.

6. The MRAM of claim 1, wherein:  
each heating element is a diode.

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7. The MRAM of claim 4, wherein:  
the resistive layer comprises at least one of of the  
materials Si, Ge, Se, C, SiC, TaO<sub>2</sub>, WSi, CoSi, FeSi,  
PtSi, TaN, FeAlN and SiN.

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8. The MRAM of claim 5, wherein:  
the dielectric layer comprises at least one of the  
materials Al<sub>2</sub>O<sub>3</sub>, AlN, SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, BN, MgO and Ta<sub>2</sub>O<sub>5</sub>.

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9. The MRAM of claim 6, wherein:  
the diode comprises at least one of amorphous silicon  
and single crystalline silicon.

10. The MRAM of claim 1, wherein:

20 each memory device is a tunneling magneto-resistance  
(TMR) memory device.

11. A computer system comprising:

25 a central processing unit,  
a main board coupled to the central processing  
unit and magnetic memory devices coupled to the main  
board, each magnetic memory device comprising:  
an array of magnetic memory cells;  
a plurality of word and bit lines  
30 connecting columns and rows of the memory  
cells, each memory cell having a magnetic  
reference layer and a magnetic data layer, each  
reference layer and each data layer having a

magnetization being switchable between two states under the influence of a magnetic field; and

5                   a plurality of heating elements each proximate to a respective reference layer and in use providing for localized heating of the respective reference layer so as to reduce the coercivity of the reference layer to facilitate switching of the respective reference layer  
10                  without switching of the data layers.

12. A method for operating an MRAM device the device comprising an array of MRAM cells switchable between two states under the influence of a magnetic field,

15                  each MRAM cell having a reference layer and a data layer, the method comprising the steps of:

heating at least one reference layer; and  
utilizing the generated heat to reduce the coercivity of the at least one reference layer and  
20                  facilitate switching of the at least reference layer without switching of the data layers.

13. The method of claim 12, wherein:

25                  the step of heating of the at least one reference layer comprises directing a current through a heat-inducing layer.

14. The method of claim 12, wherein:

30                  the step of heating the at least one reference layer comprises directing a current through a resistive heat-inducing layer.

15. The method of claim 12, wherein:

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the step of heating the at least one reference layer comprises directing a tunneling current through a dielectric layer.